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Chloride Total Maximum Daily Load for the Calleguas Creek Watershed and Tributaries -- Staff Report

California Regional Water Quality Control Board, Los Angeles Region

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1.0 INTRODUCTION

This document provides a summary of the information and methodology used by the U.S. Environmental Protection Agency (USEPA) and the California Regional Water Quality Control Board, Los Angeles Region (Regional Board) in the development of a Total Maximum Daily Load (TMDL) for chloride discharges to the Calleguas Creek watershed. This abbreviated document is based on the Staff Technical Support Document for Chloride Total Maximum Daily Load Analysis, Calleguas Creek Watershed (California Regional Water Quality Control Board -- Los Angeles, CRWQCB-LA, 2001a); referred to herein as the ¡§Technical Support Document.

The goal of this TMDL is to quantify the pollutant reductions needed to meet the water quality standards for chloride in Calleguas Creek. Water quality standards include water quality objectives (WQO), support of beneficial uses, and antidegradation policies. The Calleguas Creek Total Maximum Daily Load (TMDL) for chloride is being established in accordance with section 303(d) of the Clean Water Act, because the State of California has determined that the water quality standards for the Calleguas Creek watershed and tributaries are exceeded due to excess chloride. In accordance with Section 303(d), the State of California periodically identifies "those waters within its boundaries for which the effluent limitations . . . are not stringent enough to implement any water quality standard applicable to such waters." The waters are identified on the State¡¦s 303(d) list. In th 1996 and 1998 303(d) lists, the Regional Board identified the Calleguas Creek Watershed and tributaries as impaired due to chloride.

In accordance with a consent decree (*Heal the Bay, Inc., Santa Monica Baykeeper, Inc. et al. v. Browner & Marcus*, No. 98-4825, March 22, 1999), March 22, 2002 is the deadline for establishment of this TMDL. USEPA and the Regional Board are jointly establishing the Calleguas Creek Chloride TMDL because the State of California is not expected to complete adoption of this TMDL by the above deadline. USEPA¡¦s TMDL analysis i based on existing water quality standards and objectives of chloride and beneficial uses in Calleguas Creek, readily available information, and technical efforts produced by the Regional Board staff. USEPA¡¦s TMDL establishment action includes the followin elements:

- Regulatory Background
- Problem Statement
- Numeric Target
- Source Analysis
- TMDLs & Allocations.

The scope of USEPA¡¦s TMDL establishment does not include implementation, monitorin or cost considerations. Generally speaking, USEPA supports the implementation and monitoring strategies proposed by the Regional Board for this TMDL.

1. Regulatory Background

Southern California has seen a general trend in increasing chloride levels in many of its watersheds. These increases have been attributed in part to the effects of drought and increasing reliance on imported water. During the drought that began in the 1980s and continued through the early 1990s, many dischargers in the Los Angeles Region had difficulty meeting the chloride discharge limits. Although, chloride levels were expected to subside after the drought, many waterbodies continued to be impaired for chloride.

In 1997, the Regional Board adopted Resolution 97-02 (the Chloride Policy) which revised the chloride water quality objectives (WQOs) upward to 190 mg/L for specified reaches of the Los Angeles River and 180 mg/L in the San Gabriel River. However, the chloride objectives were not revised in the Calleguas Creek and Santa Clara River watersheds due to concerns for agricultural water supplies, which are especially sensitive to chloride levels. Rather, the Regional Board extended the interim limits in these watersheds and directed staff to carefully determine the chloride WQO that would fully support the agricultural beneficial use. (See Table 1). The interim limits are due to expire on March 29, 2002.

Table 1. Interim Chloride Limits for Specified Stream Segments

Calleguas Creek watershed segments for which existing dischargers are subject to Interim Chloride Limits	Interim Chloride Discharge Limit
Arroyo Simi and tributaries-upstream of Madera Road	160 mg/L
Arroyo Simi- downstream of Madera Road, Arroyo Las Posas, and tributaries	190 mg/L
Calleguas Creek and tributaries-between Potrero Road and Arroyo Las Posas (including Conejo Creek, Arroyo Conejo, and Arroyo Santa Rosa)	190 mg/L

Section 303(d) of the Clean Water Act (CWA) requires that ¡§each St at e s hal l i dentif those waters within its boundaries for which the effluent limitations ¡ Kar e not stri ngen enough to implement any water quality standard applicable to such waters.¡¨ The C W also requires states to establish a priority ranking for waters on the 303(d) list of impaired waters and establish TMDLs for such waters.

The elements of a TMDL are described in 40 CFR 130.2 and 130.7 and Section 303(d) of the CWA, as well as in USEPA guidance (USEPA, 1991). A TMDL is defined as the ¡§s u m of t he i nd vi dual wast e l oad al l ocati ons f or poi nt s our ces and l oad al l ocati ons f o non-point sources and natural background¡¨ (40 CFR 130. 2) s ucht hat t he capacit y of t h waterbody to assimilate pollutant loadings (the loading capacity) is not exceeded. A TMDL is also required to account for seasonal variations and include a margin of safety to address uncertainty in the analysis (USEPA, 2000).

States must develop water quality management plans to implement the TMDL (40 CFR 130.6). The USEPA has oversight authority for the 303(d) program and is required to review and either approve or disapprove the TMDLs submitted by states. If USEPA disapproves a TMDL submitted by a state, USEPA is required to establish a TMDL for that waterbody.

The Regional Board identified more than 700 waterbody-pollutant combinations in the Los Angeles Region where TMDLs would be required (LARWCQB, 1996, 1998). A schedule for developing TMDLs in the Los Angeles Region was established in the consent decree (<u>Heal the Bay Inc., et al. V. Browner</u> C 98-4825 SBA). As described in the introduction, USEPA plans to comply with the consent decree and establish a chloride TMDL on or before March 22, 2002. However, USEPA¡¦s TMDL will not include a implementation plan. The TMDL adopted by the Regional Board, including the implementation plan, will become effective only after it has been reviewed and approved by the State Water Resources Control Board (SWRCB), the Office of Administrative Law, and USEPA.

In December 2000, staff presented the Regional Board with a proposed Basin Plan Amendment to revise the chloride WQO in specified reaches of the Santa Clara River. During the preparation of that amendment, staff evaluated the water quality necessary to support the irrigation of chloride sensitive crops, including avocados. Based on this investigation, staff concluded that, although crops may tolerate some fluctuation in chloride concentrations, irrigation water containing chloride in concentrations of greater than 100-120 mg/L on a regular basis would not fully support the irrigation of avocado crops.

As a result of this work, staff reviewed the existing chloride WQO for Calleguas Creek, where agricultural water supply also is an important beneficial use. Staff concluded that the existing chloride WQOs in some segments of Calleguas Creek are higher than historical water quality and are too high to fully support the beneficial uses. Staff will be presenting a separate Basin Plan amendment to change the chloride objective in some reaches of Calleguas Creek from 150 mg/L to 110 mg/L. The proposed WQO would be assessed based on a rolling 12-month average, with a maximum, not-to-exceed value of 180 mg/L chloride.

The WQO combines the use of a rolling average concentration and a maximum not-to-exceed value to ensure the protection of the chloride-sensitive crops. Literature values and testimony from local growers indicated that avocados could be grown successfully with irrigation water containing an average chloride concentration of between 100 and 120 mg/L. Severe and permanent damage to avocado trees was reported when irrigated with water containing about 180 mg/L chloride. The maximum not to exceed value was added to ensure protection of the avocado crops. The proposed revision of the WQO would apply only to the northern tributaries of the watershed, where the production of avocado crops is most prevalent. The proposed WQO is consistent with the historic water quality in these reaches. The rationale used in setting the WQO is described more fully in ¡§Proposed Basin Plan Amendment to Revise the Reach Definitions and Chloride Water

Quality Objectives for Calleguas Creek,¡¨ (CR WQCB- LA, 2001b)). This TMDL is designed to attain the proposed WQOs, which are deemed necessary to fully support the beneficial use and to comply with federal and state antidegradation policies.

Figure 1 Environmental Setting

The Calleguas Creek watershed area is 343 square miles in Ventura County in an area with a long history of agriculture and recent trends of rapidly growing population. The watershed has three general areas: the northern tributaries, the Arroyo Las Posas/Arroyo Simi system and its tributaries; the southern tributaries, Conejo Creek and its tributaries; and the Calleguas Creek main stem. Revolon Slough and its tributaries drain to the estuary; they are not tributary to Calleguas Creek. [1] This TMDL addresses chloride-related listings along the main stem of Calleguas Creek to the estuary and the listed tributaries. Recently, staff has proposed redefining the reaches in Calleguas Creek to better capture the variation in flow conditions, beneficial uses, and stream characteristics. The reach definitions referenced in the TMDL reflect those proposed in the WQO Staff Report. The proposed reaches are depicted in Figure 1 and described in Table2.

[1] Revolon Slough and Beardsley Channel were not listed on the 1998 303(d) list for chloride and are not addressed in this TMDL.

Figure 1. Calleguas Creek Watershed with Gauging Stations and Reaches (Click on the image to enlarge view)

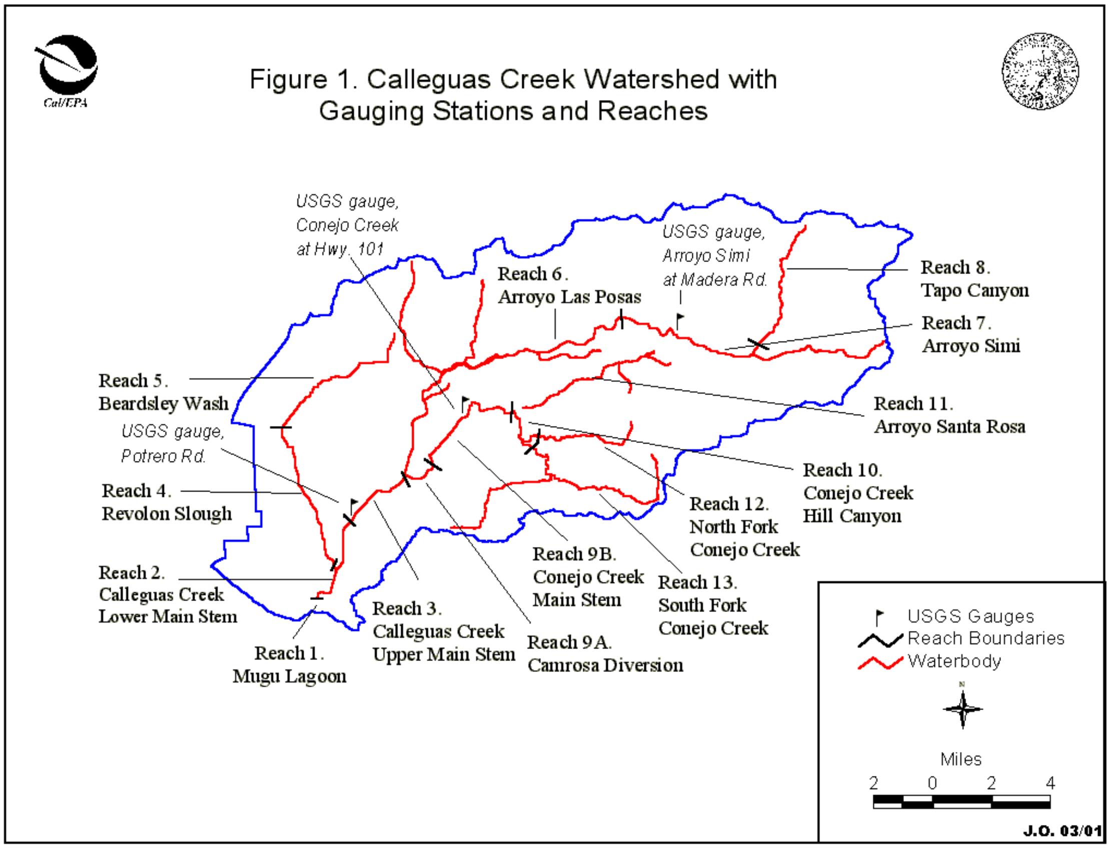


Table 2. Calleguas Creek Reaches.

Reach No.	Reach Name	Geographic Description	Chloride Sensitive Beneficial Uses	Notes: Hydrology, land uses, etc.
1	Mugu Lagoon	Lagoon fed by Calleguas Creek		Estuarine; brackish, contiguous with Pacific Ocean
2	Calleguas Creek South	Downstream (south) of Potrero Road		Tidal influence; impermeable layer; tile drains; Oxnard Plain groundwater basin contains both confined and unconfined aquifers.
3	Calleguas Creek North	Potrero Road upstream to confluence Conejo Creek	AGR (E) GWR (E)	No tidal influence. Surface water designated beneficial uses include existing AGR and GWR. Agricultural tile drains present. Camrosa WWRF discharges to percolation ponds and surface water. Pleasant Valley groundwater basin includes confined (impermeable layer) and unconfined perched aquifers. Both are designated as existing AGR.
4	Revolon Slough	Revolon Slough from confluence with Calleguas Creek Estuary to Central Avenue	AGR (E) GWR (E)	Surface water designated beneficial uses include existing AGR and GWR. Agricultural tile drains present. Concrete lined between Central Ave. and Wood Rd; from there the slough is soft-bottomed with rip-rapped sides. Pleasant Valley groundwater basin includes confined (impermeable layer) and unconfined perched aquifers. Both are designated as existing AGR.
5	Beardsley Wash	Revolon Slough upstream of Central Avenue		Surface water is not designated for AGR or GWR. This rip-rapped channel drains the hills north from the City of Camarillo to Revolon Slough. Agricultural tile drains present.
6	Arroyo Las Posas	Confluence with Conejo Creek to Hitch Road	AGR (P); GWR (E)	Surface water designated as potential AGR and existing GWR. Normally dry at Calleguas confluence except during storm events. Las Posas groundwater basin designated as AGR. Ventura Co. WWTP discharges to percolation ponds and surface water at Moorpark, west from Hitch Road. An important avocado growing region.

Table 2. Calleguas Creek Reaches.

Reach No.	Reach Name	Geographic Description	Chloride Sensitive Beneficial Uses	Notes: Hydrology, land uses, etc.
7	Arroyo Simi	End of Arroyo Las Posas (Hitch Rd) to headwaters in Simi Valley	GWR (I)	Surface water designated intermittent GWR, no AGR designation for surface water but flows downstream to Arroyo Las Posas, which has potential AGR and existing GWR. Simi Valley WQCF discharges to surface water. Simi Valley groundwater basin includes both confined and unconfined aquifers. Both are designated as AGR; pumped groundwater and shallow groundwater discharges to surface water. Avocado production present in the lower segments of this reach; tributary to an important avocado growing region.
8	Tapo Canyon	Confluence with Arroyo Simi up Tapo Canyon to headwaters	AGR (P); GWR (I).	Surface water designated intermittent GWR in Gillibrand Canyon Creek and potential AGR in Tapo Canyon Creek. Tributary to Arroyo Simi and Arroyo Las Posas, where AGR and GWR are designated. Gillibrand groundwater basin designated as AGR. Tributary to an important avocado growing region.
9A	Conejo Creek	Extends from the confluence with Calleguas Creek to the Camrosa Diversion	AGR (E); GWR (E)	Surface water designated as existing AGR and GWR. Camarillo WWTP discharges to surface water. Pleasant Valley groundwater basin contains both confined and unconfined perched aquifers. Both are designated as AGR. Limited cultivation of salt-sensitive crops.
9B	Conejo Creek main stem	Extends from Camrosa Diversion to the Confluence with Arroyo Santa Rosa	AGR (E); GWR (E)	Surface water designated as existing AGR and GWR. Pleasant Valley groundwater basin contains both confined and unconfined perched aquifers. Both are designated as AGR. Limited cultivation of salt sensitive crops.

Table 2. Calleguas Creek Reaches.

Reach No.	Reach Name	Geographic Description	Chloride Sensitive Beneficial Uses	Notes: Hydrology, land uses, etc.
10	Hill Canyon reach of Conejo Creek	Confluence with Arroyo Santa Rosa to confluence with N. Fork; and N. Fork to just above Hill Canyon WWTF	GWR (I)	Surface water designated as intermittent GWR. This reach receives N. Fork surface water that exceeds the WQO of 150 mg/L. The Hill Canyon WWTF discharges upstream of the confluence with N. Fork. Conejo groundwater basin designated as existing AGR. Limited cultivation of salt-sensitive crops.
11	Arroyo Santa Rosa	Just upstream from the confluence with Conejo Creek to headwaters	GWR (I)	Surface water designated as intermittent GWR. Olsen Rd. WRP to be decommissioned and influent to be diverted to the Hill Canyon WWTF. Dry before the confluence with Conejo Creek, except during storm flow. Arroyo Santa Rosa groundwater basin designated as AGR. Limited cultivation of salt-sensitive crops.
12	North Fork Conejo Creek	From just above Hill Canyon WWTF to headwaters of the North Fork	AGR (E) GWR (E)	Surface water designated as existing AGR and GWR, but currently exceeds chloride WQO of 150 mg/L. Limited cultivation of salt-sensitive crops.
13	South Fork Conejo Creek	Confluence with N. Fork to headwaters of the South Fork¡ X w channels	GWR (I);	Surface water designated as intermittent GWR. Groundwater exceeds chloride WQO of 150 mg/L. Pumped Groundwater discharges to surface water. Limited cultivation of salt-sensitive crops.

(d) Beneficial use designated for this reach in 1994 Basin Plan. (n.o.) Beneficial use not observed in this reach, even though designated in Basin Plan. (o) Beneficial use is observed, but not designated in Basin Plan. Ag: Agriculture. GW: Groundwater. GWR: Groundwater Recharge. WQO: Water Quality Objective. POTW: Publicly Owned Treatment Works (discharger of treated municipal wastewater).

THE TMDL

The TMDL must contain certain specified elements to fulfill the Clean Water Act and federal regulations. Most importantly, the TMDL must demonstrate that the Waste Load Allocations (WLAs) and Load Allocations (LAs) are set at a level that will attain all applicable water quality standards, including designated beneficial uses, narrative water quality standards, numeric water quality objectives and State and federal anti-degradation policies. The analysis included consideration of the following information:

- The 1998 303(d) listing of beneficial uses that are impaired due to chloride levels within the Calleguas Creek watershed
- More recent information regarding beneficial uses and water quality
- Planned changes within the watershed, including a major surface water diversion, which is currently under construction
- The impacts of surface water and shallow groundwater interactions
- Finally, staff carefully assessed the parameters resulting in the critical condition, and designed the TMDL to meet applicable water quality standards under those conditions.

A review of staff¡¦s analysis and the TMDL development are presented in the followin subsections.

1. Problem Statement and Identification

This section reviews the data used by the Regional Board that led to the conclusion that Calleguas Creek is impaired for chloride. Where available, more recent data were reviewed to confirm the 303(d) listing. As the Regional Board¡¦s listing decisions ar based on impairments to water quality, it is appropriate to begin this section with a discussion of the applicable water quality standards.

State standards consist of the following elements: 1) beneficial uses, 2) narrative standards and numeric standards and 3) an antidegradation policy. In California, the Regional Board defines beneficial uses in the Water Quality Control Plan, Los Angeles Region (Basin Plan). Numeric standards for toxics can be found in the California Toxics Rule (40 CFR 131.38).

Table 2.1 in the Basin Plan for the Los Angeles Regional (1994) lists 14 beneficial uses for Calleguas Creek. Excerpts from this table are reproduced in Table 3, herein. These uses are specified as existing (E), potential (P) or intermittent (I) uses. All beneficial uses must be protected.

Table 3. Reaches of Calleguas Creek Watershed, Beneficial Uses, and Description. Excerpt from the Basin Plan, Table 2-1.

Reach	Hydro. Unit No.	MUN	IND	PROC	AGR	GWR	FRSH	NAV	REC 1	REC 2	COM
Calleguas Creek	403.11	P*			E	E	E		E	E	
Calleguas Creek	403.12	P*	E	E	E	E			Eq	E	
Revolon Slough	403.11	P*	P		E	E			Eq	E	
Beardsley Channel	403.61	P*					E		E	E	
Conejo Creek	403.12	P*	E	E	E	E			Eq	E	
Conejo Creek	403.63	P*				I	I		I	I	
Arroyo Conejo	403.64	P*				I	I		I	I	
Arroyo Conejo	403.68	P*				I	I		I	I	
Arroyo Santa Rosa	403.63	P*				I	I		I	I	
Arroyo Santa Rosa	403.65	P*				I	I		I	I	
North Fork Arroyo Conejo	403.64	P *			E	E			E	E	
Arroyo Las Posas	403.12	P*	P	P	P	E			E	E	
Arroyo Las Posas	403.62	P*	P	P	P	E	E		E	E	
Arroyo Simi	403.62	P*	I			I	I		I	I	
Arroyo Simi	403.67	I*	I			I	I		I	I	
Tapo Canyon Creek	403.66	I*		P	P	I			I	I	
Tapo Canyon Creek	403.67	I*		P	P	I			I	I	
Gillibrand Canyon Creek	403.66	P*				I	I		I	I	
Gillibrand Canyon Creek	403.67	P*				I			I	I	

Reach	WARM	COLD	EST	MAR	WILD	BIOL	RARE	MIGR	SPWN	SHELL	WET
Calleguas Creek	E	E			E		Ep				E
Calleguas Creek	E				E						
Revolon Slough	E				E						E
Beardsley Channel	E				E						
Conejo Creek	E				E						
Conejo Creek	I				E				E		
Arroyo Conejo	I				E		E				
Arroyo Conejo	I				E						
Arroyo Santa Rosa	I				E						
Arroyo Santa Rosa	I				E						
North Fork Arroyo Conejo	E				E				E		
Arroyo Las Posas	E	P			E						
Arroyo Las Posas	E	P			E						
Arroyo Simi	I				E		E				
Arroyo Simi	I				E						
Tapo Canyon Creek	I				E						
Tapo Canyon Creek	I				E						
Gillibrand Canyon Creek	I				E						
Gillibrand Canyon Creek	I				E						

E: Existing beneficial use. P: Potential beneficial use. I: Intermittent beneficial use. p: Habitat of the Clapper Rail. q: Whenever flows are suitable. * Astrixed MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date.

The Calleguas Creek waterbody segments listed in the 1998 303 (d) list for chloride are described in Table 4. In each listing, agricultural water supply (AGR) was identified as the beneficial use not supported due to chloride levels.

Table 4. Summary of 303(d) List of Chloride Water Quality Limited Segments in the Calleguas Creek Watershed

WATERBODY NAME	HYDR UNIT	SIZE (stream miles)
Tapo Canyon	403.67	5.23
Arroyo Simi (Moorpark Fwy (23) to Brea Cyn	403.62	7.58
Arroyo Las Posas (Fox Barranca to Moorpark Fwy (23)	403.62	9.62
Calleguas Creek (Potrero to Somis Rd)	403.12	7.7
Conejo Creek (Santa Rosa Rd to Thousand Oaks City Limit)	403.63	2.67
Arroyo Las Posas (Lewis Somis Rd to Fox Barranca)	403.12	1.99
Conejo Creek (Above Lynn Rd.)	403.68	4.98

From 1978 to 1998 and beyond, the chloride WQO Calleguas Creek north from Potrero Road was established at 150 mg/L. A chloride objective was not established for the Mugu Lagoon and the Calleguas Creek Estuary, due to tidal influences.

The 1998 303(d) listing was based on exceedances of the WQO of 150 mg/L. In order for a waterbody to be considered impaired, at least 25% of samples within the data set had to exceed the standard. If at least five data points were found in the 1995 ¡V1998 data set those data were used in the 1998 303(d) assessment. If less than five data points were found, older data were included in the assessment. The 1998 list also includes listings from 1996, where new data were not assessed in 1998. In 1996, waterbody segments were listed if more than 10% of the samples exceeded the WQO.

1.a. Agricultural Beneficial Use Impairment

The agricultural beneficial use (AGR) is defined in the Basin Plan as ¡§uses of water fo farming, horticulture, or ranching including, but not limited to irrigation, stock watering, or support of vegetation for range grazing.¡¨ For the Calleguas Creek watershed, a existing or potential agricultural supply water beneficial use is listed for Calleguas Creek (Reach 3), Conejo Creek (Reach 9, 10, and 12), Arroyo Las Posas (Reach 6), and Tapo Canyon (Reach 8), as shown in Tables 2 and 3. In addition, staff has observed agricultural beneficial uses in Arroyo Simi (Reach 7) and Santa Rosa (Reach 11).

The quality of the agricultural supply water in the Calleguas Creek watershed has diminished with economic implications for growers, especially in certain areas.

Agricultural supply water in Conejo Creek downstream of the confluence of the North and South Forks has increased in chloride concentration. Other users are affected in the Arroyo Las Posas area, where the decline in quality of the shallow aquifers strongly affects a productive agricultural region largely served by the Zone Mutual Water Company (Zone Mutual). Zone Mutual pumps water from 30-foot wells adjacent to the river, drawing from the shallow or perched aquifers. Other impacts in agricultural beneficial use are discussed the Technical Support Document and the WQO Staff Report.

1.b. Groundwater Recharge Beneficial Use Impairment

The GWR beneficial use is defined by the Basin Plan (CRWQCB, 1994) as ¡§uses of wate for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.¡ For the Calleguas Creek watershed, an existing or potential groundwater recharge beneficial use is listed for all reaches included in this TMDL. In some areas the recharge enters deep aquifers, and in other areas the recharge enters shallow or perched aquifers. Both kinds of aquifers are heavily used in various parts of the watershed.

The deeper aquifers of the North Las Posas, Pleasant Valley, and Oxnard Forebay basins show increasing chloride concentration over recent decades (CRWQCB database, 1957-present). Chloride concentration in some wells, during some periods, routinely exceeds established WQOs for the beneficial use to which the groundwater is applied. For shallow or perched groundwater, this increase may be directly related to an increase in surface water chloride concentrations. Groundwater recharge with higher chloride levels also likely contributes to the increase in chloride levels in deep aquifers. However, other factors including concentration from agricultural, exacerbated by the overdraft condition of these aquifers also likely contribute to the continuing decline in the deep aquifer water quality. Those aquifers have been reported to be in overdraft since at least the 1960s (USGS, 1980; Bookman-Edmonston Engineering, Inc., 1998).

Although the 303(d) listing identified AGR as the beneficial use impaired by chloride, staff have concluded that the groundwater recharge (GWR) beneficial use also has been impaired in some segments of the watershed. Specifically, the GWR beneficial use is impaired where surface water recharges shallow groundwaters, and those shallow groundwaters are used to irrigate chloride sensitive crops.

1.c. Other Beneficial Uses

Other beneficial uses are not impaired at present, and the recommended changes in objectives will not affect other beneficial uses. Ambient conditions in freshwater reaches of the watershed are within the tolerance of freshwater aquatic life and human health. Human health is not affected by current ambient conditions, and conditions rarely exceed the secondary Maximum Contamination Limit (MCL) standard of 250 mg/L. This TMDL will not result in increased concentration of chlorides in those reaches, and the reduced concentrations anticipated are not detrimental to any other beneficial uses. Two types of endangered and rare species known to use the watershed: pinnepeds, saltwater mammals limited to Mugu Lagoon, where the reduced chloride loads resulting from this TMDL will not appreciably affect ambient conditions; and the Clapper Rail, a bird that uses both Mugu Lagoon and freshwater reaches of Calleguas Creek, and is known to be tolerant of saline conditions.

1.d. Surface Water Quality Conditions

The CRWQCB database includes chloride concentration measurements for various locations in the waterbody. The data set for the northern tributaries, (Arroyo Las Posas/Arroyo Simi) reaches extends from 1951 to 1997. The period from 1951 through 1974 consisted of 43 samples. The average chloride concentration was 112 mg/L, with a standard deviation of 179 mg/L. Eight samples, or 19%, exceeded the average. The data set for the period from 1975 through 1986 consisted of 17 samples. The average chloride concentration for this period was 109 mg/L, with a standard deviation of 96 mg/L. In this data set, 53% of the samples exceeded the average. The average concentration during the most recent period, from 1987 through 1997, rose to 194 mg/L, with a standard deviation of 190 mg/L; 13% of the 30 samples exceeded the average.

The data set reviewed for the southern tributaries (Conejo Creek and its tributaries) extended from 1951 through 1997, with approximately 30 samples taken from 1951 through 1974, 56 during the period from 1974 through 1986, and 167 from 1986 through 1997. The data set shows an increasing trend in the chloride concentrations in Conejo Creek beginning with an average chloride concentration of about 80 mg/L for the period prior to 1975, rising to 116 mg/L for the period of from 1975 through 1986, and to 179 mg/L from 1986 through 1987. During the period from 1975 through 1986, only one sample exceeded the WQO of 150 mg/L. In the period from 1987 through 1997, 75% of the samples exceeded the existing WQO of 150 mg/L. The Calleguas Creek Characterization Study or CCCS (LWA, 2000) measured chloride concentration 10 to 12 times at each of 29 sites throughout the watershed from July 1998 through June 1999. Results of the CCCS for some key locations are summarized in Table5.

Table 5. Calleguas Creek Characterization Study Chloride Concentration Results, 12 samples once monthly, July 1998 - June 1999.

Reach	CCCS Station Number	Concentration, mg/L		
		Minimum	Average	Maximum
Arroyo Simi, Reach 7	1	51	140	168
Arroyo Las Posas, Reach 6	4	84	150	160
Arroyo Santa Rosa, Reach 11	8	70	110	130
Conejo Creek, confluence North and South Forks, Reach 10	9	94	170	200
Conejo Creek at Hill Canyon, Reach 10	10	100	150	160
Conejo Creek at Camarillo, Reach 9	11	100	140	170

In summary, staff¡¦s review of available surface water data found substantial increasin trend in chloride concentrations since 1975. In addition the 1998 303(d) listings of waterbodies impaired for chloride, which was based on a WQO of 150 mg/L, was confirmed.

1.e. Groundwater Quality

Although groundwater quality is not addressed in the 303(d) listing process, it was necessary to characterize groundwater quality in order to assess the potential loading to surface water from groundwater discharge, and also to assess the GWR beneficial use.

At present, groundwater discharges from the shallow aquifers to the surface water in absence of pumping occur in several locations. Areas of significant groundwater discharge include the Simi Valley area, Reach 7; the upper reaches of Conejo Creek, Reaches 12 and 13; the Santa Rosa Valley, portions of Reaches 9 and 11; and in Reach 3, near the confluence with Conejo Creek and near the Camrosa WWRF.

Chloride concentration in groundwater is high enough to impair beneficial uses in some locations, especially in the upstream reaches in the vicinity of the cities of Simi Valley (Reach 7) and Thousand Oaks (Reach 13). The CRWQCB database for groundwater quality shows that concentrations of chloride have generally increased over the period of record. Recent data show a general increasing chloride concentration trend. The increasing groundwater concentration affects, and is in turn affected by, surface water concentration in the watershed. Other mechanisms include pumping of groundwater for dewatering, hazardous waste site remediation, and irrigation; and natural recharge and discharge, especially from shallow aquifers in particular parts of the watershed.

The chloride concentrations in shallow groundwater are greater than the proposed WQO for all areas except in Reach 11, where the concentration is 130 mg/L, 20 mg/L less than the WQO of 150 mg/L. In Reaches 9 and 12 the concentration is approximately equal to the proposed WQO of 150 mg/L.

2. Numeric Targets

This TMDL is designed to attain the proposed WQOs specified in the WQO Staff Report (CRWQCB-LA, 2001b), including an explicit margin of safety of 10%. The beneficial use guidelines in the Basin Plan specify that ¡§protection of the most sensitive beneficial use(s is the determining criteria for the selection of effluent limits.¡¨ As described in the Staf Report, the proposed chloride objectives were designed to fully support the most sensitive beneficial uses within each reach, which were determined to be agricultural water supply and groundwater recharge, where groundwater is used to irrigate salt-sensitive crops. Furthermore, differences in agricultural practices were considered when selecting the appropriate objective. The proposed reach designations and chloride WQOs are presented in Table 6. An amendment to the Basin Plan proposed for 2002 would modify WQOs for Calleguas Creek, based on beneficial uses designated or observed for each reach. Table 6 lists the beneficial uses designated and observed for each reach, and the current and proposed WQOs for each reach.

The WQO Basin Plan amendment proposes different WQOs for some reaches in order to account for the varying sensitivity of different crops to chloride concentrations in the irrigation water. The amendment is designed to protect waters used to irrigate crops in each reach, with special emphasis on crop types that were viable or potentially viable in 1975. The WQO Staff Report describes the analysis used to establish protection of the irrigation and groundwater beneficial uses by reach, along with the rationale for establishing the WQO for certain reaches at 110 mg/L. The proposed WQO of 110 mg/L is a rolling 12-month average concentration with a maximum not-to-exceed limit of 180 mg/L. Numeric targets are to be met during all seasons and under all conditions in order to protect the beneficial uses at all times.

3. Source Assessment.

The TMDL requires an estimate of loadings from point sources and non-point sources. In the TMDL process waste load allocations are established for point sources and load allocations are established for non-point sources. Point sources typically include discharges for which there is a definite discharge pipe such as wastewater treatment plant discharges, storm water outfalls, and industrial discharges. These discharges are regulated through a permit such as the National Pollution Discharge Elimination System (NPDES) permit or the State¡¦s Waste Discharge Requirements (WDRs). Non-point sources b definition include pollutants that originate from a number of diffuse sources.

There are four main sources of chloride to Calleguas Creek and its tributaries. During critical conditions, described below, the sources are estimated to discharge the following chloride loads: POTWs contribute 21,200 lb/day, groundwater discharges are 16,700 lb/day and miscellaneous non-storm runoff is 12,900 lb/day. Stormwater runoff contributes 35,000 lb/day, but it does not contribute to an impairment because during storm flows the chloride is diluted below concentration levels, which would affect beneficial uses.

Figure 2, the map of flow sources, also shows the location of loads to the waterbody. The figure includes POTWs, groundwater discharge, and urban non-storm runoff. Table 7 summarizes the largest sources of chloride to the waterbody, listed under the reaches that receive each discharge. These are called ¡§major dischargers¡¨. A number of smaller loa are also known. These are called ¡§minor dischargers,¡¨ included on Table 7 in aggregat form, for example as a single line showing the total of all pumped groundwater discharges in Reach 13 and all agricultural drainage in Reach 3. Table 7 displays all loads in terms of lb/day converted to an equivalent annual average, excluding loads from urban stormwater runoff. Urban stormwater runoff was excluded due to the finding that no impairment occurs during storm conditions.

Table 6. Numeric Targets for Calleguas Creek and Tributaries, by Reach.

Reach Number	Reach Name	Chloride Sensitive Beneficial Uses	1994 Basin Plan WQO (mg/L)	2001 proposed amended WQO (mg/L)
1	Mugu Lagoon		No water body specific objective	No water body specific objective
2	Calleguas Creek South		No water body specific objective	No water body specific objective
3	Calleguas Creek North	AGR (E); GWR (E)	150	150
4	Revolon Slough	AGR (d); GWR (d)	150	150
5	Beardsley Wash		150	150
6	Arroyo Las Posas	AGR (P); GWR (E)	150	110*
7	Arroyo Simi	GWR (I)	150	110*
8	Tapo Canyon	AGR (P); GWR (I)	150	110*
9A	Conejo Creek	AGR (E); GWR (E)	150	150
9B	Conejo Creek	AGR(E); GWR(E)	150	150
10	Hill Canyon reach of Conejo Creek	GWR(I)	150	150
11	Arroyo Santa Rosa	GWR (I)	150	150
12	North Fork Conejo Creek	AGR(E); GWR(E)	150	150
13	South Fork Conejo Creek	GWR(I);	150	150

(d) Beneficial use designated for this reach in 1994 Basin Plan. (n.o.) Beneficial use not observed in this reach, even though designated in Basin Plan. (o) Beneficial use is observed, but not designated in Basin Plan.

AGR: Agriculture. GW: Groundwater. GWR: Groundwater Recharge. WQO: Water Quality Objective.

AGR (sensitive): Observed agricultural beneficial use includes irrigation of crops known to be sensitive to chloride, as described in CRWQCB-LA (2001).

*WQO of 110 mg/L based on a 12-month rolling average, with a maximum, not-to-exceed of 180 mg/L.

4. Seasonal Variation and Critical Condition.

TMDLs must be developed to ensure compliance with water quality standards during critical conditions, taking into account seasonal variation. For many pollutants, the highest concentrations occur during low flow conditions, which usually occurs during the late summer and early fall seasons As such, the seven-day-ten-year low flow (7Q10) or another low flow measure often is identified as the ¡§critical¡¨ condition However, Calleguas Creek, the highest chloride concentrations occur during maximum non-storm conditions, and these concentrations are even higher during and shortly after a drought. Staff believes that groundwater discharges to the creek are responsible for the increased chloride loading during these conditions. These conditions may occur more frequently during the late winter and early spring seasons, but staff's analysis concluded that these conditions can occur during any season. Therefore seasonality was not a determining factor in defining the critical condition for this TMDL.

This TMDL establishes WLAs based on routine critical conditions (i.e., maximum non-storm flows) and drought critical conditions (i.e., maximum non-storm flows during a drought). For the purposes of this TMDL, the drought period is defined as beginning on June 1st, of any year in which the previous 12 months¡¦ total rainfall is less than 11.0 inche and continuing until June 1st, when the previous 12 months¡¦ total rainfall is at least 12 inches. As described in the Technical Support Document, these rainfalls correlate with a meteorological definition of drought as defined by the National Drought Mitigation Center (1995), and is comparable with the California Department of Water Resources¡ operational definition of drought as described in the Department¡¦s 2000 drought report

The WLA is defined for routine days using critical conditions because this could occur on any given day, without advanced notice. Using critical conditions for every day also allows for a greater margin of safety, as required in developing TMDLs. The development of critical conditions and data used for that analysis, are described in detail in the Technical Support Document.

Figure 2. Approximate Locations of Point and Non-point Discharges and Sinks in Calleguas Creek Watershed (Click on the image to enlarge view)

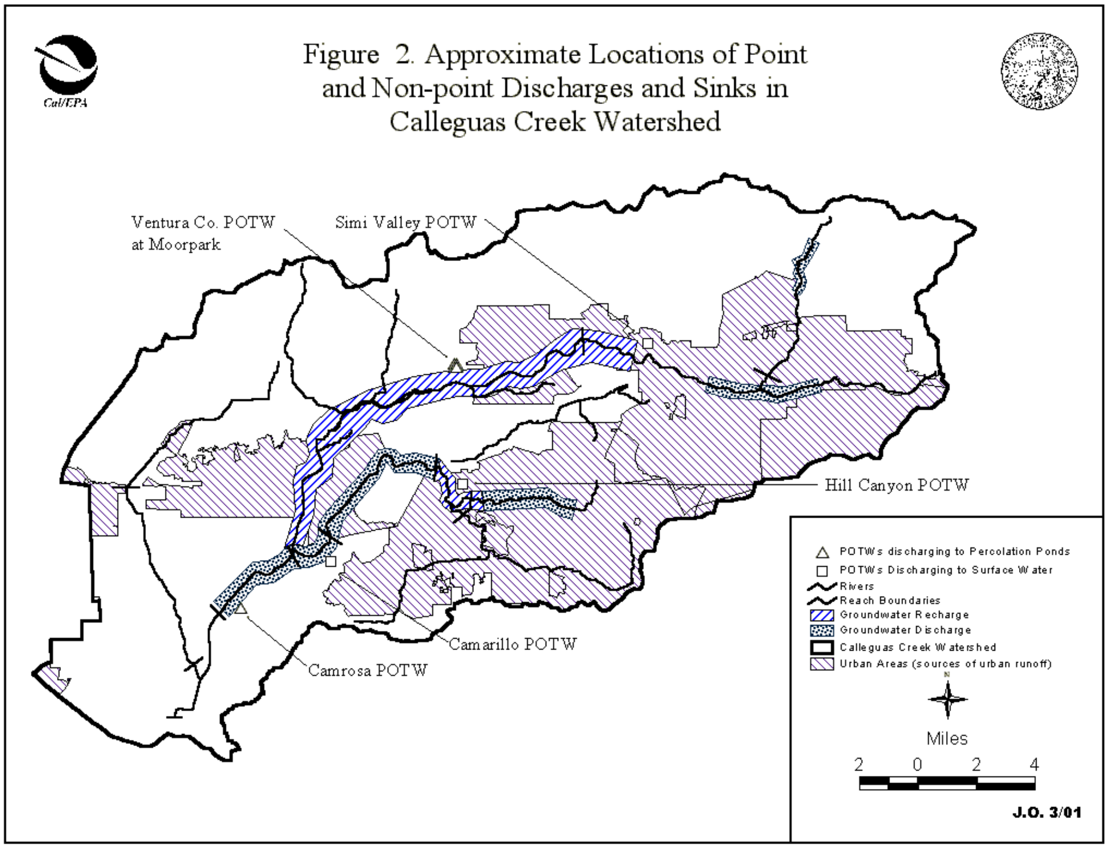


Table 7. Summary of Chloride Loads and Source Activities, by Reach

Reach	Treated Municipal Wastewater (POTWs)			Groundwater			Miscellaneous Other		
Discharge	**Flow ft^3/s**	**Conc mg/L**	**Mass lb/day**	**Flow ft^3/s**	**Conc mg/L**	**Mass lb/day**	**Flow ft^3/s**	**Conc mg/L**	**Mass lb/day**
Tapo Canyon, Reach 8									
Groundwater discharge				1	160	850			
Urban non-storm runoff							2	130	1,400
Arroyo Simi, Reach 7									
Groundwater discharge				1	160	850			
Urban non-storm runoff							1	100	530
Groundwater discharge				2	150	1,600			
Pumped groundwater**							3	150	2,400
Simi Valley POTW	14.1	113	8,500						
Arroyo Las Posas, Reach 6									
Moorpark POTW*	3.1	118	2,000						
Conejo Ck S Fork, Reach 13									
Groundwater discharge				1.5	160	1,300			
Pumped groundwater**							0.5	160	420
Urban non-storm runoff							3	160	2,600
Conejo Ck N. Fork, Reach 12									
Groundwater discharge				3	150	2,400			
Urban non-storm runoff							2	150	1,600
Arroyo Santa Rosa, Reach 11									
Groundwater discharge				3	130	2,100			
Urban non-storm runoff							1.5	100	800
Conejo Ck Hill Cyn, Reach 10									
Hill Canyon POTW	15.2	118	9,600						
Conejo Creek, Reach 9									
Groundwater discharge				3	150	2,400			
Urban non-storm runoff							0.8	100	430
Camarillo POTW	3.3	175	3,100						
Calleguas Ck, Reach 3									
Groundwater discharge				1.6	250	2,100			
Agricultural discharge**							2	250	2,700
Camrosa POTW *	2.3	250	3,100*						
Rising groundwater near									
Camrosa POTW				2.3	250	3,100			
TOTALS			21,200			16,700			12,900

*Discharge to groundwater, therefore load and flow are not included in in-stream totals. ** Does not describe minor point source dischargers separately.

5. Linkage Analysis

The linkage analysis of a TMDL process is intended to characterize the physical relationship between sources of the pollutant and impaired conditions in the watershed. Source data provides one part of the TMDL equation. It is also necessary to determine the carrying capacity of the receiving water to accommodate chloride loadings. This section describes the use of a mass balance water quality model to relate chloride loadings in the Calleguas Creek to water quality concentrations.

Some chloride sources in the Calleguas Creek watershed originate as point discharges and others as non-point discharges, but all have geographic specificity. Conditions in impaired reaches of the waterbody are functions of a wide variety of factors including: the timing, magnitude, and location of sources; transport of the pollutant in the stream system; and the assimilative capacity of each reach, which is in turn primarily a function of hydrology and the amount of water present in the reach. This TMDL uses the best available data and a simplistic but defensible modeling approach. However, the TMDL necessarily contains some uncertainties because the complex interrelationships are not fully understood.

For a chemically conservative pollutant such as chloride, the linkage analysis is simplified because it needs to consider only transport, not transformation, of the substance. Therefore the linkage analysis was conducted with a mass-balance model based on spreadsheet-style calculation of inflows and outflows for each reach. The Technical Support Document describes the model assumptions, the input information about chloride sources and reach interrelationships during critical and non-critical conditions, and the resulting use of the model to predict the impact of specified load allocations for this TMDL. The mass balance model uses a plug-flow approach, so discharge from an upstream reach to a downstream reach is computed using the equation:

$$Q\ out = Qin_1 + Qin_2 + . . . + Qin_n \text{ ¡ V} Qwithdrawals$$

The model assumes immediate and complete mixing of all inputs within each reach, and no chemical changes in the constituent of concern within the waterbody. Therefore in-stream conditions for each reach are calculated using flow volume and chloride concentration of inflows to the reach, using the equation:

$$C\ out = 1/Qout\ (Cin_1Qin_1 + Cin_2Qin_2 + . . . + Cin_nQin_n)$$

Withdrawals and outflows from each reach are assumed to convey chloride in the same concentration, the concentration produced by mixing within the reach.

The model, which was based on best available information, was used to conduct a linkage analysis, by predicting conditions at various locations in the waterbody under changing conditions. This analysis was used to evaluate the potential impact of dischargers¡ proposed changes and their ability to meet the numeric targets in this TMDL. The analysis also was used to verify that the identified critical conditions do in fact result in the highest modeled concentration. Finally, the analysis was used to evaluate whether the impairment would be successfully removed given characteristics of current and planned discharges from regulated sources and considering the impact of the Camrosa Diversion, which is presently under construction.

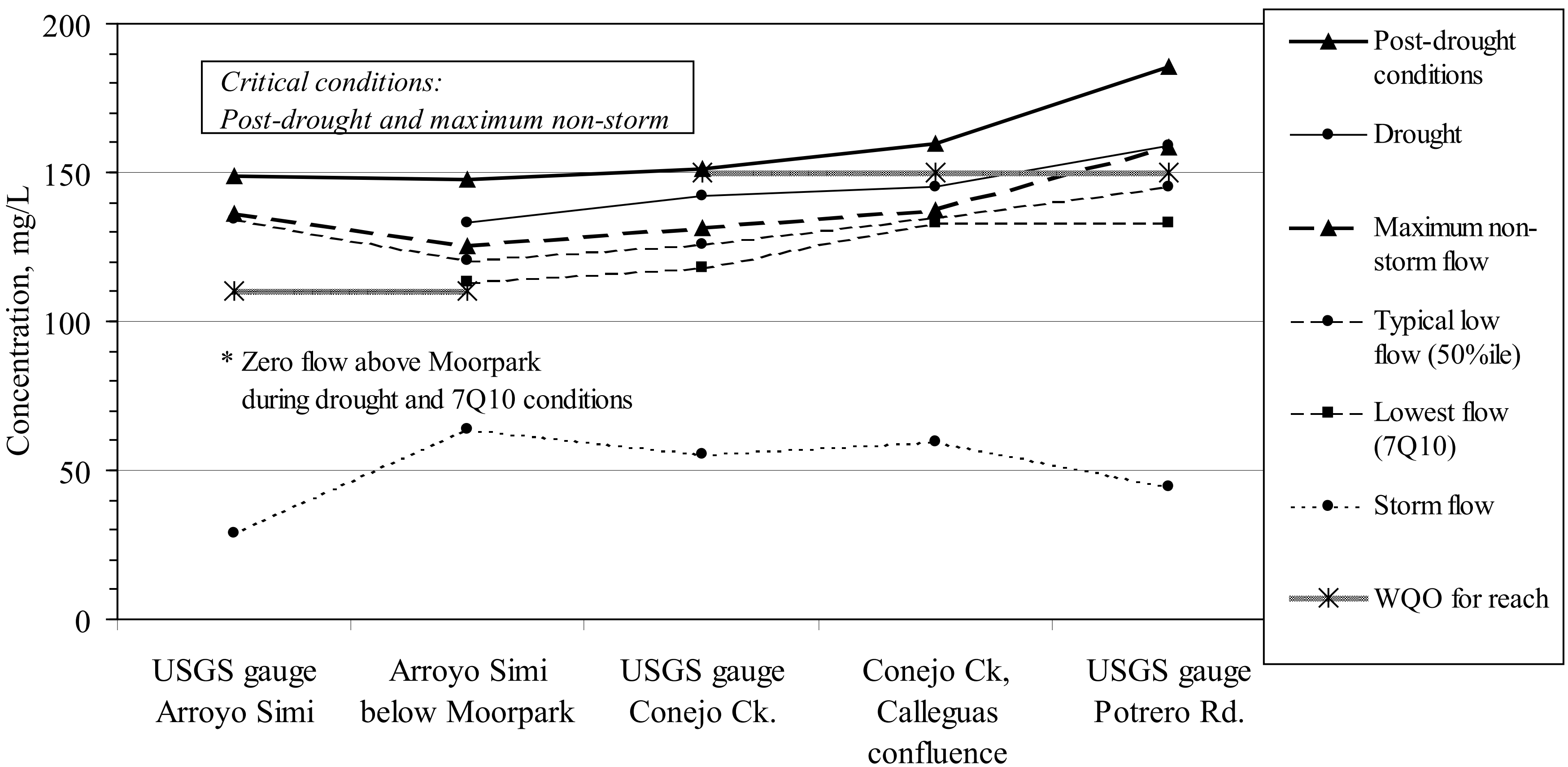
The model requires information for all inflows and outflows at a number of locations, and in several conditions, where few or no measurements have been made of flow volume or chloride concentration in the waterbody. In cases where adequate data were not available, Regional Board staff made assumptions about flow and chloride load consistent with the best available data. All assumptions have been made consistent with the best available information, and using staff¡¦s best professional technical judgment. Further documentatio and examples of the calculations can be found in the Technical Support Document (as can a discussion on critical conditions). Concentrations of chloride under various conditions are shown as results of the linkage analysis in Figure 3.

The Regional Board¡¦s characterization of the Calleguas Creek Watershed in the Technica Support Document identified five major point source discharges that are the POTWs permitted under the National Pollutant Discharges Elimination System (NPDES). Additionally, much of the chloride comes from nonpoint sources. These include urban non-storm runoff, groundwater discharge, and agricultural discharge. In addition, several minor point source discharges that result from groundwater remediation projects are located in Reach 13. (See Section 6.)

6. Allocation of Loads and Waste Loads

This section uses the results of the linkage analysis above to propose load allocations (LAs) for loads from natural background sources and other nonpoint sources, and waste load allocations (WLAs) for currently permitted point source discharges. The proposed LAs and WLAs are calculated such that WQOs will be attained in all parts of the waterbody. Calculated LAs and WLAs use results of the linkage analysis in the previous section, and incorporating a margin of safety. LAs and WLAs are proposed for two conditions, one for routine days, defined as all non-storm, non-drought days, calculated based on the critical condition of maximum non-storm flow. The other set of LAs and WLAs are proposed for drought conditions, and are calculated based on the critical condition of the immediate post-drought period. Both sets of LAs and WLAs are calculated assuming the Reach 9A diversion will reduce in-stream flow in that reach to 6 ft^3/sec under all conditions.

Figure 3 Linkage Analysis Model Results



6.a. Margin of Safety

A number of measured and estimated parameters in this TMDL have some degree of uncertainty. Therefore LAs and WLAs proposed in this section incorporate both an implicit and an explicit margin of safety.

As shown in Figure 3 and described in the Technical Support Document, maximum flow non-storm days constitute the critical condition with the worst case conditions occurring after a drought. Critical conditions are discussed in detail in the Technical Support Document.

The implicit margin of safety is applied by calculating LAs and WLAs for all days using the critical conditions. That maximum non-storm flow may occur in any season and under circumstances that cannot be reliably forecast, so the LAs and WLAs need to be set at a level that can accommodate those conditions as they should occur. This assumption produces a margin of safety because the critical conditions do not in fact occur on every day not affected by storm runoff, so on most days of a given year the LAs and WLAs are conservative. Use of the critical conditions as an implicit margin of safety is reasonable because the waterbody¡¦s assimilative capacity for chloride is so strongly dependent on in stream flow, which varies both for reasons that have been documented (such as seasonal and precipitation events) and for other reasons less well understood.

The explicit margin of safety is applied by using the model to compute LAs and WLAs that would reach a target in-stream chloride concentration that is 10% less than the WQO for each reach. Setting WLAs using a target concentration 10% less than the WQO reserves a certain portion of the stream¡¦s assimilative capacity to accommodate th uncertain loads.

Applying an explicit margin of safety in additional to the implicit margin of safety is reasonable because many of the chloride loads in the watershed are not precisely quantifiable with the data available, and the linkage analysis has been completed using estimates whose precision is not known. A number of uncertain estimates are accommodated by the explicit margin of safety. In particular, the estimated existing loads from groundwater and other non-point sources are uncertain due to the small number of historical sampling occurrences.

6.b. Summary of LAs and WLAs by Reach

Tables 8 and 9 summarize the proposed WLAs for major discharges and aggregated WLAs for minor discharges, and LAs for non-point sources during routine conditions and drought conditions, respectively. The proposed allocations are selected such that the modeled in-stream chloride concentration does not exceed the WQOs for any reach of the waterbody during critical conditions, including an explicit margin of safety.

Table 8 summarizes WLAs and LAs under routine conditions. Those conditions are assumed to exist on any day of the year that is not influenced either by storm flow or by drought conditions (defined below). WLAs and LAs for routine conditions are calculated based on conditions during maximum non-storm flow assumed to apply on routine days, as discussed above. Any given day when flow is not diluted by storm runoff could attain that critical condition.

Table 9 summarizes WLAs and LAs for major dischargers under drought conditions. The proposed allocations are selected such that the modeled in-stream chloride concentration does not exceed the WQOs for any reach of the waterbody during drought conditions, including an explicit margin of safety. Allocations for the drought condition are more rigorous than those specified for everyday critical conditions, based on the linkage analysis results that show waterbody chloride concentration is substantially greater during drought conditions and in the period immediately following a drought.

Droughts are produced by long-term rainfall and runoff patterns, and vary in duration, runoff volume, and conditions of flow and chloride load. Each drought period is likely to produce unique conditions, and data are not available in sufficient detail, for sufficient periods of time, to create a historical statistical model that would predict future conditions. Therefore, in-stream conditions are estimated using the estimated ¡§typical lo flow¡¨ conditions in the mass balance model, supplemented by the assumption that mos groundwater discharges will decline to zero.

As described earlier, for the purposes of this TMDL, the drought period is defined as beginning on June 1st, of any year in which the previous 12 months¡¦ total rainfall is les than 11.0 inches and continuing until June 1st, when the previous 12 months¡¦ total rainfal is at least 12.2 inches.

Several minor point source dischargers were identified in Reach 13. WLAs for these minor dischargers were based on a discharge concentration equal to the applicable target concentration (136 mg/L for routine conditions and 124 mg/L for drought conditions) and the permitted daily flow. These WLAs for the minor dischargers are presented in Table 10.

Table 8. Specified WLAs and LAs, with Percent Change: Critical Conditions.*

Reach	Current Loads, Critical Conditions		Changes Proposed by TMDL			
Discharge	**Flow, ft^3/s**	**Mass, lb/day**	**Reduced Mass Lb/day**	**Percent Reduction in Mass**	**Target Conc., mg/L**	**LA / WLA, lb/day**
Tapo Canyon, Reach 8						
Groundwater discharge	1	850	0	0	160	850
Urban non-storm runoff	2	1,400	0	0	130	1,400
Arroyo Simi, Reach 7						
Groundwater discharge, headwaters	1	850	0	0	160	850
Urban non-storm runoff	1	530	0	0	100	530
Pumped groundwater	3.0	2,400	1,200	50%	83	1,200
Simi Valley POTW	14.1	8,500	2,500	29%	83	6,000
Groundwater discharge, near Simi Valley	2	1,600	0	0	150	1,600
Arroyo Las Posas, Reach 6						
Moorpark POTW	3.1	2,000	400	20%	100	1,600
Conejo Creek South Fork, Reach 13*						
Groundwater discharge	1.5	1,280	0	0	160	1,300
Pumped Groundwater	0.5	430	70	16%	136	360
Urban non-storm runoff	3	2,600	0	0	160	2,600
Conejo Creek North Fork, Reach 12						
Groundwater discharge	3	2,400	0	0	150	2,400
Urban non-storm runoff	2	1,600	0	0	150	1,600
Arroyo Santa Rosa, Reach 11						
Groundwater discharge	3	2,100	0	0	130	2,100
Urban non-storm runoff	1.5	800	0	0	100	800
Conejo Creek Hill Canyon, Reach 10						
Hill Canyon POTW	15.2	9,600	-500	-5%	125	10,100
Conejo Creek main stem, Reach 9B						
Groundwater discharge	2	1,400	0	0	130	1,400
Urban non-storm runoff	0.8	430	0	0	100	430
Conejo Creek main stem, below diversion, Reach 9A						
Groundwater discharge	2	1,600	0	0	150	1,600
Camarillo POTW	3.3	3,100	800	26%	133	2,300
C**alleguas Creek Main Stem, Reach 3**						
Groundwater discharge near Conejo confl.	1.6	2,100	1,000	48%	136	1,100
Agricultural discharge	2	2,700	1,400	52%	136	1,300
Camrosa POTW	2.3	3,100	1,600	52%	136	1,500
Groundwater discharge near Camrosa POTW	2.3	3,100	1,600	52%	136	1,500

* Allocations to groundwater discharges (other than pumped groundwater) and urban runoff are LAs. Allocations to pumped groundwater are WLAs.

Table 9. Specified WLAs and LAs, with Percent Change: Drought Conditions*

Reach	Loads under Post-Drought Conditions		Changes Proposed by TMDL			
Discharge	**Flow, ft^3/s**	**Mass, lb/day**	**Reduced Mass, lb/day**	**Percent Reduction in Mass**	**Target Conc., mg/L**	**LA / WLA, lb/day**
Tapo Canyon, Reach 8						
Groundwater discharge	1	1,000	0	0	192	1,000
Urban non-storm runoff	2	1,400	0	0	130	1,400
Arroyo Simi, Reach 7						
Groundwater discharge, headwaters	1	1,000	0	0	192	1,000
Urban non-storm runoff	1	530	0	0	100	530
Pumped groundwater	3.0	2,900	1,800	62%	74	1,100
Simi Valley POTW	14.1	10,200	5,000	49%	74	5,200
Groundwater discharge, near Simi Valley	2	1,900	0	0	180	1,900
Arroyo Las Posas, Reach 6						
Moorpark POTW	3.1	2,300	700	30%	100	1,600
Conejo Creek South Fork, Reach 13						
Groundwater discharge	1.5	1,500	0	0	192	1,500
Pumped groundwater	0.5	500	170	36%	124	330
Urban non-storm runoff	3	2,600	0	0	160	2,600
Conejo Creek North Fork, Reach 12						
Groundwater discharge	3	2,900	0	0	180	2,900
Urban non-storm runoff	2	1,600	0	0	150	1,600
Arroyo Santa Rosa, Reach 11						
Groundwater discharge	3	2,500	0	0	156	2,500
Urban non-storm runoff	1.5	800	0	0	100	800
Conejo Creek Hill Canyon, Reach 10						
Hill Canyon POTW	15.2	11,500	1,800	16%	124	9,700
Conejo Creek main stem, Reach 9B						
Groundwater discharge	2	1,700	0	0	156	1,700
Urban non-storm runoff	0.8	430	0	0	100	430
Conejo Creek main stem, below diversion, Reach 9A						
Groundwater discharge	2	1,900	500	26%	136	1,400
Camarillo POTW	3.3	3,700	1,500	41%	136	2,200
Calleguas Creek Main Stem, Reach 3						
Groundwater discharge	1.6	2,600	1,600	62%	136	1,000
Agricultural discharge	2	3,200	1,900	59%	136	1,300
Camrosa POTW	2.3	3,700	2,200	59%	136	1,500
Groundwater discharge near Camrosa POTW	2.3	3,700	2,200	59%	136	1,500

* Allocations to groundwater discharges (other than pumped groundwater) and urban runoff are LAs. Allocations to pumped groundwater are WLAs.

Table 10. Calculated WLAs for Pumped Groundwater Discharges in Reach 13*

Discharger	Flow, ft^3/s	Load, lb/day* @ 136 mg/L Cl	Load, lb/day* @ 124 mg/L Cl
Northrop	0.017	12	11
Rockwell (Tonexant)	0.033	24	22
Teleflex	0.15	110	100
Al-sal	0.056	41	37
Chevron	0.067	49	45
Chevron	0.067	49	45
Emery	0.00046	0.33	0.30
ARCO	0.017	12	11
Mobil	0.017	12	11
Mobil	0.067	49	45

* Flow information based on current NPDES permit.

7. Implementation

This TMDL establishes WLAs and LAs as a total chloride load, which will result in the attainment of the applicable WQO. As a result of the TMDL, NPDES permits will limit both the allowable load and concentration of future discharges. The loadings were calculated based on the amount that can be discharged, given the present day assimilative capacity of the creek and taking into account the future impacts of the Camrosa Diversion, which is now under construction. Any future significant changes in the flow of the creek would necessitate a re-evaluation of the available assimilative capacity and the allowable loads and target concentrations, as specified in this TMDL.

Stakeholders have begun considering possible remedies to the chloride impairment of Calleguas Creek in anticipation of this TMDL. Some efforts have been directed toward source reduction measures and more in-depth analyses of the potential impact of irrigated agriculture. In particular, the use of self-regenerating water softeners is known to be a significant source of chloride in the Santa Clara River watershed, and is likely a source in the Calleguas Creek watershed. Additional efforts to educate the public in the use and impact of water softeners could reduce the chloride concentration of some POTW dischargers.

The potential for irrigated agriculture to concentrate chloride levels in confined aquifers also has been discussed, and it has been suggested that an ¡§Agricultural Oversigh Committee¡¨ be formed to investigate this issue further. However, it is believed that th impact of agriculture on shallow, confined aquifers, may be a more localized problem and will not solve the watershed-wide trend in increasing chloride concentrations in Calleguas Creek, its tributaries, and the shallow, unconfined aquifers that are in close communication with the creek.

Evaluation of potential source reduction measures and the initiation of an Agricultural Oversight Committee are two actions that can be undertaken in the near-term and which do not require extensive capital resources. It is assumed that these activities would commence during the first two years of implementation. These measures are not expected to solve the chloride impairment in total. However, reductions achieved through these means may change the configuration of chloride treatment within the watershed and ultimately reduce the cost of treatment. While stakeholders are encouraged to undertake such studies, the studies are not required by the TMDL.

Major dischargers and/or water districts have identified the likely need to treat wastewater in various parts of the watershed, and convey the residual brine directly to the Pacific Ocean in a conveyance known as a ¡§brine line.¡¨ Construction of this pipeline requir planning, designing, acquisition of right-of-way, and subsurface pipe installation. The implementation of this TMDL is scheduled in stages to meet the time requirements of construction of this possible remedy, as projected by Calleguas Municipal Water District. Table 11 presents the implementation schedule for WLAs that are to be achieved in conjunction with the brine line.

Staff proposes extending the currently effective interim chloride limits for POTWs and extending the limit to apply to all point source discharges until the brine line becomes available.

Table 11. Calleguas Creek Watershed Chloride TMDL Implementation Schedule

Activity	Discharge Limits	Date
Establish an Agricultural Oversight Committee and Initial Pollution Prevention Plan Study of Market Penetration of self-regenerating water softeners. (Optional)	160 mg/L Reach 8 and Reach 7 upstream of Madera Road. 190 mg/L Reach 7 downstream of Madera Rd. and Reaches 6, 13, 12, 11, 10, 9B, 9A, and 3.	Effective date of TMDL
Report on extent of agricultural compliance with BMPs by Agricultural Oversight Committee and report on water softener market penetration. (Optional)	Same as above	2 years after effective date of TMDL
Brine Line complete through Camarillo. Desalter complete in vicinity of Conejo-Calleguas confluence. Beginning of RO treatment shake down period.	Same as above	6/30/04
End of RO treatment shake down period in Reach 3 and Conejo Creek Reaches.	WLAs for Reaches 13, 12, 11, 10, 9B, 9A and 3. 160 mg/l for Reach 7 and 8 above Madera Rd. 190 mg/L for Reaches 7 below Madera Road and Reach 6.	12/30/04
Brine Line complete to Simi Valley POTW. Reverse osmosis (RO) process complete at or near Simi Valley POTW. Beginning of RO treatment system shakedown period.	WLAs for Reaches 13, 12, 11, 10, 9B, 9A and 3. 160 mg/l for Reach 8 and Reach 7 above Madera Rd. 190 mg/L for Reach 7 below Madera Rd. and Reach 6.	3/31/05
End of RO treatment system shake down period for Arroyo Simi.	WLAs effective in all reaches	9/30/05

8. Cost Considerations

The Porter-Cologne Water Quality Control Act, Water Code section 13241(d), requires staff to ¡§consider costs¡¨ associated with the establishment of water quality objective The TMDL does not establish water quality objectives, but is merely a plan for achieving the existing water quality objective. Therefore cost considerations required in section 13241 are not required for this TMDL.

The purpose of this cost analysis is to provide the Regional Board with information concerning the potential cost of implementing this TMDL. This section takes into account a reasonable range of economic factors in fulfillment of the applicable provisions of the California Environmental Quality Act (Public Resources Code, section 21159).

Staff estimated the cost of reverse osmosis based on economic evaluations prepared for the adjacent Santa Clara River (CRWQCB-LA, 2000). The total cost for a proposed brine line was assumed to be $50 million, based on information supplied by the Calleguas Municipal Water District. It also was assumed that minor dischargers, and pumped groundwater, and agricultural drains would truck wastewater to the nearest RO treatment location. Fees collected from the minor dischargers would help offset the cost of the treatment and brine line construction. However, these fees have not been included in the cost estimate presented herein.

The estimated volumes of effluent that must be treated by RO to meet the TMDL during worst-case (i.e., drought conditions) are presented in Table 12. Current flows and chloride concentrations under critical drought conditions were taken from Table 9, as were the target chloride concentrations (see columns 1-4 of Table 12). It was assumed that only a portion of the POTW influent would be treated with RO, and blended with the remaining effluent to meet the applicable numeric target. Based on information supplied by the Sanitation Districts, it was assumed that the RO treatment would reduce the chloride concentration by 96%, and that the chloride would be concentrated in the treatment brine, which would amount to 15% of the RO influent flow. The RO treated effluent therefore would be equal to 85% of the RO influent. The RO treated effluent would be blended with the remaining POTW effluent to meet the numeric target. Considering these assumptions, the percentage of effluent that must be treated with RO to achieve a ¡§blende concentration¡¨ of less than the numeric target was calculated and is presented in column of Table 12.

The total capital costs for both RO treatment and the brine line are presented in Table 13. Capital costs were calculated based on $5.4 million per MGD of treatment capacity, based on information supplied by the Sanitation Districts. The brine line costs were apportioned to all of the POTWs based on their estimated brine flow and distance from the last brine discharge point, assuming that the brine line route approximates that of the creek flow. Furthermore, it was assumed that the Hill Canyon WWTF could meet its numeric target during routine critical conditions through modification to its existing disinfection process. However, during drought conditions, it is likely that the Hill Canyon Plant would have to treat a small portion of its influent to reduce chloride loadings to ensure compliance with the numeric target of 136 mg/L in Conejo Creek. Given the relatively small volume of brine that would be produced during these conditions and considering the objections to extending the brine line to the Hill Canyon plant, it is assumed that the brine would be trucked to the Camarillo WWTP. However, it was expected that the City of Thousand Oaks would contribute to the cost of constructing the brine line. For the purposes of allocating a share, Hill Canyon was assigned 1.5 miles of the ¡§extended brin line construction¡¨ factor; and its total share of the brine line would be 6 %

Calculated annual costs are presented in Table 14. Annual capital costs were calculated assuming an interest rate of 7% to be financed over 20 years. Annual operating cost for the RO treatments were calculated assuming a cost of $1,245 per million gallons of treated influent. It was assumed that RO treatment and the brine line will be constructed to meet the worst-case scenario and therefore, drought conditions were used. O&M costs also are based on worst-case drought conditions. The actual brine line may be sized larger to accommodate future growth or other effluent discharges, however; the purpose of this estimate is to calculate the increase in monthly sewage rates for existing users. It is assumed that capital expenditures designed to accommodate future growth will be paid for through hookup fees and special assessments, and will not represent a burden to existing ratepayers.

Table 12. Estimates of Reverse Osmosis Treatment (Drought Scenario)

POTW/Discharger	Influent Flow ft3/sec	MGD	Cl Conc (Existing) mg/L	Cl Conc Target mg/L	Fow Treated %	Flow Treated MGD	Treated Flow (-brine) MGD	Treated Effluent Conc mg/L	Untreated Effluent MGD	Untreated Conc mg/L	Blended Effluent Conc. mg/L
Simi Valley GW pumped	3	1.94	180	74	0.66	1.28	1.09	7.19	0.66	180	72.30
Simi Valley WQCP	14.1	9.11	134	74	0.55	5.01	4.26	5.38	4.10	134	68.71
Simi Total						6.29					
Moorpark	3.1	2.00	138	100	0.33	0.66	0.56	5.52	1.34	138	98.86
Hill Canyon	15.2	9.82	141	124	0.25	2.45	2.09	5.63	7.36	141	110.85
Pumped GW fr. Reach 13	0.5	0.32	186	124	0.45	0.15	0.12	7.44	0.18	186	112.71
GW discharge fr Reach 9A	2	1.29	177	136	0.33	0.43	0.36	7.07	0.87	177	126.59
Camarillo WWTP	3.3	2.13	208	136	0.45	0.96	0.82	8.34	1.17	208	126.37
Camarillo Total						3.99					
GW discharge near Conejo confluence	1.6	1.03	302	136	0.66	0.68	0.58	12.08	0.35	302	121.53
Agricultural Discharge	2	1.29	297	136	0.66	0.85	0.72	11.90	0.44	297	119.66
Camrosa WWRF	2.3	1.49	299	136	0.66	0.98	0.83	11.96	0.51	299	120.31
Camrosa Total						2.52					

* Assumptions: 1) Treatment reduces chloride concentration by 96%
2) 15% of treated wastewater is disposed of as brine.

Table 13. Total Capital Costs (Treatment and Brine Disposal) for Drought Conditions

POTW/Discharger	RO $MM Capital*	Brine Flow MGD	Stream Miles	Brine Line % from last	Brine Line Line Cost $MM	Total Total Cap Cost	Annual RO O&M $MM **
Simi Valley GW pumped		0.19					
Simi Valley WQCP		0.75					
Simi Total	$ 33.96	0.94	5.3	0.53	26.62	$ 60.58	$ 2.86
Moorpark	$ 3.57	0.10	13	0.14	6.86	$ 10.43	$ 0.30
Hill Canyon	$ 13.26	0.37	1.5	0.06	2.94	$ 16.20	$ 1.11
Pumped GW fr. Reach 13	0.78	0.02					0.07
GW discharge	2.30	0.06					0.19
Camarillo WWTP	5.18	0.14					0.44
Camarillo Total	$ 7.48	0.23	3	0.07	3.67	$ 11.15	$ 0.63
GW discharge near Conejo confluence	3.68	0.10				3.68	0.31
Agriculture	4.60	0.13				4.60	0.39
Camrosa WWRF	5.30	0.15				5.30	0.44
Camrosa Total	$ 13.58	0.38	5.2	0.21	10.45	$ 24.03	$ 1.14
Watershed Totals		2.02	28***	1.01	50.54	$ 122.40	$ 6.04

* Assumes capital cost of $5.4 MM per MGD of treated flow.
** RO O&M estimated at $1,245 per million gallons treated.
*** Additional brine line miles and ocean outfall costs to be shared equally among POTWs.

Table 14. Annual Calculated Costs Assuming Drought Conditions

Organization	Interest Rate	Time Financed (Years)	Annualization Factor	Tot. Treat. Cap. Cost ($MM)	Total Share Brine Line ($MM)	Total Capital Cost ($MM)	Annual Capital Cost($MM)	Annual Operating Cost($MM)	Total Annual Cost($MM)
Simi Valley	0.07	20	0.094392926	33.96	26.62	60.58	5.72	2.86	8.58
Moorpark	0.07	20	0.094392926	3.57	6.86	10.43	0.98	3.00	3.98
Hill Canyon	0.07	20	0.094392926	13.26	2.94	16.20	1.53	1.11	2.64
Camarillo	0.07	20	0.094392926	7.48	3.67	11.15	1.05	0.63	1.68
Camrosa	0.07	20	0.094392926	13.58	10.45	24.03	2.24	1.14	3.38
Camrosa w/o Ag RO cost	0.07	20	0.094392926	8.59	10.45	19.04	1.80	0.75	2.55

The affordability of RO treatment and the construction of a brine line was assessed based on the estimated increase in sewer or user fees (see Table 15) and the resultant fees compared to fees paid by other California communities (see Table 16).

Table 15 Monthly Sewer Rate Increase to Existing Ratepayers

POTW	Existing Rate ($/month)[1]	Added Annual Cost ($MM)	No. of ¡§Residentia Sewage Units¡	Adjusted Rate ($/month)
Simi Valley	16.10	8.58	33,786[2]	37.26
Moorpark	12.50	3.98	10,500[3]	
Hill Canyon	20.65	2.64	49,000[4]	25.14
Camarillo	21.08	1.68	12,172[5]	32.58
Camrosa including Agricultural Drains	16.00	3.38	8,257[5]	50.11[6]
Camrosa without Agricultural Drains	16.00	2.55	8,257	41.73

1. SWRCB. May 2001. Wastewater User Charge Survey Report F.Y. 2000-01.
2. Personal Communication. Larry Whitney, Simi Valley WQCP.
3. Personal Communication. Reddy PaKala, Ventura County WWTP.
4. Personal Communication. Dean Moralez, Hill Canyon WWTF.
5. Personal Communication. Douglas Frost. Camarillo Sanitation District.
6. Assumes that Camrosa ratepayers would absorb cost for treatment agricultural drain water. In actuality, farmers likely will be assessed a fee to cover these costs. Ratepayer¡¦s fees would be reducedt approximately $42 per month, without the cost of treating the agricultural drain water.

Table 16 provides a sampling of monthly sewage rates from Ventura County and the State of California. A comparison of these rates with the rates projected in Table 15 find that the projected monthly rates are greater than the 2000 average in Ventura County ($23.15), but below the highest rate in the county ($73.75). The rates are less than the average rates paid in San Francisco County. Since the projected costs, which are based on worst-case assumptions, are within the range of fees paid by ratepayers within Ventura County and the State of California, the staff considers them affordable.

Table 16. Range in sewage rates for California statewide and selected metropolitan areas*

Location	Monthly user charge
California ¡ V Lo	$ 5.00
Ventura County, average	$ 23.15
California, average	$ 19.82
San Francisco County, average	$ 45.37
Ventura County Service Area 29 (Ventura County ¡ V High	$ 73.75
California ¡ V Hig	$ 145.50

* SWRCB. May 2001. Wastewater User Charge Survey Report F.Y. 2000-01.

9. Monitoring

The WLAs specified in this TMDL will be established as NPDES permit limits for the POTWs and minor dischargers in Reach 13. Discharge monitoring as specified in the NPDES permits will be used to evaluate compliance with the WLAs. Ambient monitoring performed as part of the State-wide Ambient Monitoring Program (SWAMP), in conjunction with monitoring performed by local stakeholders, will be used to evaluate the effectiveness of the TMDL.

Stakeholders will be encouraged to monitor in-stream conditions after WLAs are implemented to verify the waterbody meets the specified WQOs. Monitoring should be sufficiently comprehensive to determine whether the identified critical conditions represent all critical conditions. The monitoring might identify whether chloride concentration exceeds WQOs routinely under any identifiable conditions, such as seasonal variations in flow or changes in chloride entering the surface water over the longer term. If additional critical conditions are identified, this TMDL should be revised to protect beneficial uses under those conditions.

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